

WHAT IS CLAIMED IS:

- 1           1.       A fire fighting vehicle comprising:
  - 2                   (A)     a chassis and a vehicle body mounted on the chassis, the  
3 chassis and vehicle body in combination including an operator compartment capable  
4 of receiving a human operator, the operator compartment including steering and  
5 throttle controls for receiving operator inputs to control movement of the fire fighting  
6 vehicle along a road;
  - 7                   (B)     a turret including
    - 8                           (1)     an adjustable mount assembly, the adjustable mount  
9 assembly being mounted to the chassis and vehicle body combination, and  
10 the mount assembly including a fire-extinguishing agent delivery system  
11 capable of transporting a fire-extinguishing agent through the mount  
12 assembly,
    - 13                           (2)     a turret nozzle, the turret nozzle being mounted to the  
14 adjustable mount assembly, and the turret nozzle being capable of receiving  
15 the fire-extinguishing agent from the mount assembly;
  - 16                   (C)     an operator interface, the operator interface being configured  
17 to receive operator inputs; and
  - 18                   (D)     a turret control system, the turret control system including a  
19 plurality of actuators capable of adjusting the mount assembly to permit the position  
20 and orientation of the turret nozzle to be adjusted, the turret control system further  
21 including a turret controller coupled to the plurality of actuators, the turret controller  
22 being configured to receive an operator input from the operator interface and to  
23 control subsequent movement of the turret according to a stored profile selected in  
24 accordance with the operator input.
- 1           2.       The vehicle according to claim 1, wherein the stored profile is one of a  
2 plurality of stored profiles including a turret pan profile, a turret deploy profile, and a  
3 turret pan profile, and wherein the operator interface is configured to permit the  
4 operator to select each of the turret pan profile, the turret deploy profile, and the  
5 turret pan profile at different times of turret operation.
- 1           3.       The vehicle according to claim 1,  
2                   wherein the stored profile is a turret deploy profile, and  
3                   wherein the turret deploy profile is user-configurable by way of the  
4 operator interface.

1           4.       The vehicle according to claim 3,  
2                   wherein the movement according to the turret deploy profile causes  
3 the turret to be moved to a deploy position, and  
4                   wherein the deploy position is user-configurable by way of the  
5 operator interface.

1           5.       The vehicle according to claim 1, wherein the stored profile is a turret  
2 pan profile, and wherein the turret pan profile is user configurable.

1           6.       The vehicle according to claim 5, wherein the operator interface is  
2 configured to permit the operator to specify an oscillate range for the turret pan  
3 profile.

1           7.       The vehicle according to claim 6, wherein the operator interface is  
2 configured to provide visual feedback regarding the specified oscillate range.

1           8.       The vehicle according to claim 7, wherein the visual feedback is  
2 provided using a display bar having a length that is determined by the specified  
3 oscillate range.

1           9.       The vehicle according to claim 8, wherein the display bar is a first  
2 display bar, and wherein the visual feedback is further provided using a second  
3 display bar having a length that determined by the specified oscillate range, the first  
4 and second display bars respectively indicating a range of oscillation to the right from  
5 center and a range of oscillation to the left from center.

1           10.      The vehicle according to claim 1, wherein the stored profile is a turret  
2 deploy profile.

1           11.      The vehicle according to claim 1, wherein the stored profile is a turret  
2 store profile.

1           12.      The vehicle according to claim 1, wherein the stored profile is a turret  
2 pan profile.

1           13.      The vehicle according to claim 1, wherein the adjustable mount  
2 assembly comprises a turret base and a plurality of articulated arms, the plurality of  
3 articulated arms being connected end-to-end between the turret base and the turret  
4 nozzle.

1           14.     The vehicle according to claim 13, wherein the plurality of articulated  
2 arms include an adjustable length arm having an adjustable length, and wherein the  
3 turret control system comprises a sensor that measures the length of the adjustable  
4 length arm.

1           15.     The vehicle according to claim 13, wherein the base is rotatable, and  
2 wherein the turret control system comprises a sensor that measures an angle of  
3 rotation of the base.

1           16.     The vehicle according to claim 1, further comprising a camera  
2 mounted to turret mount assembly.

1           17.     The vehicle according to claim 16, wherein the camera is an infrared  
2 camera.

1           18.     The vehicle according to claim 1, wherein the operator interface  
2 comprises a wireless interface device configured to wirelessly transmit the operator  
3 inputs to the turret control system and configured to wirelessly receive feedback  
4 information from the turret control system.

1           19.     The vehicle according to claim 1, wherein the turret controller is  
2 configured to receive the operator inputs from the wireless interface device and to  
3 control movement of the turret based on the operator inputs received from the  
4 wireless interface device.

1           20.     A fire fighting vehicle comprising:

2                   (A)     a chassis and a vehicle body mounted on the chassis, the  
3 chassis and vehicle body in combination including an operator compartment capable  
4 of receiving a human operator, the operator compartment including steering and  
5 throttle controls for receiving operator inputs to control movement of the fire fighting  
6 vehicle along a road;

7                   (B)     a turret including

8                           (1)     an adjustable mount assembly, the adjustable mount  
9 assembly being mounted to the chassis and vehicle body combination, and  
10 the mount assembly including a fire-extinguishing agent delivery system  
11 capable of transporting a fire-extinguishing agent through the mount  
12 assembly,

13                   (2)     a turret nozzle, the turret nozzle being mounted to the  
14                   adjustable mount assembly, and the turret nozzle being capable of receiving  
15                   the fire-extinguishing agent from the fire-extinguishing agent delivery system;

16                   (C)     an operator interface, the operator interface being configured  
17                   to receive operator inputs useable to control movement of the turret; and

18                   (D)     a turret control system, the turret control system including a  
19                   plurality of actuators capable of adjusting the mount assembly to permit the position  
20                   and orientation of the turret nozzle to be adjusted, the turret control system further  
21                   including a turret controller coupled to the plurality of actuators, the turret controller  
22                   storing position information relating to a desired position of the turret, and the turret  
23                   controller being programmed to control movement of the turret in accordance with the  
24                   position information and the operator inputs from the operator interface.

1                   21.     The vehicle according to claim 20, wherein the operator interface  
2                   comprises an ambidextrous joystick.

1                   22.     The vehicle according to claim 21, wherein the ambidextrous joystick  
2                   is located between first and second operator seats in the operator compartment and  
3                   is configured to be used by an operator sitting in either of the first and second  
4                   operator seats.

1                   23.     The vehicle according to claim 20, wherein the operator interface  
2                   comprises a joystick having an operator feedback device configured to provide status  
3                   information regarding status of the turret.

1                   24.     The vehicle according to claim 23, wherein the operator feedback  
2                   device comprises light emitting diodes.

1                   25.     The vehicle according to claim 20, wherein the operator inputs  
2                   comprise an indication that the operator wishes the turret to be deployed, and  
3                   wherein the turret controller controls the movement of the turret to deploy the turret in  
4                   accordance with the position information.

1                   26.     The vehicle according to claim 20, wherein the operator inputs  
2                   comprise an indication that the operator wishes the turret to move in accordance with  
3                   a predetermined pattern represented by the position information, and wherein the  
4                   turret controller controls the movement of the turret in accordance with the  
5                   predetermined pattern.

1           27.     The vehicle according to claim 20, wherein the operator inputs  
2     comprise an indication that the operator wishes the turret to be stored at a store  
3     location, and wherein the turret controller controls the movement of the turret to move  
4     the turret to the store location in accordance with the position information.

1           28.     The vehicle according to claim 20, wherein the operator interface  
2     comprises a display capable of displaying graphics.

1           29.     The vehicle according to claim 28, wherein the vehicle further  
2     comprises a video camera mounted to the turret, and wherein the display is  
3     configured to display I/O status information relating to operation of the turret  
4     simultaneously with video data from the video camera.

1           30.     The vehicle according to claim 20, wherein the vehicle further  
2     comprises an imaging device mounted to the turret.

1           31.     The vehicle according to claim 30, wherein the turret controller is  
2     configured to control movement of the turret in accordance with information received  
3     from the imaging device.

1           32.     The vehicle according to claim 31, wherein the imaging device is an  
2     infrared camera.

1           33.     The vehicle according to claim 31, wherein the imaging device is a  
2     laser detection device.

1           34.     The vehicle according to claim 20,  
2     wherein the turret is a first turret, the adjustable mount assembly is a first  
3     adjustable mount assembly, and the turret nozzle is a first turret nozzle;  
4     wherein the vehicle further comprises a second turret including  
5                 (1)     a second adjustable mount assembly, the second  
6     adjustable mount assembly being mounted to the chassis and vehicle body  
7     combination, and the second mount assembly including a fire-extinguishing  
8     agent delivery system capable of transporting a fire-extinguishing agent  
9     through the second mount assembly,  
10                (2)     a second turret nozzle, the second turret nozzle being  
11     mounted to the second mount assembly, and the second turret nozzle being

12           capable of receiving the fire-extinguishing agent from the fire-extinguishing  
13           agent delivery system; and  
14           wherein the operator interface is configured to receive information pertaining  
15   to the position and orientation of the first and second turrets, wherein the operator  
16   interface comprises a display, and wherein the operator interface is configured to  
17   provide feedback information via the display pertaining to the position and orientation  
18   of the first turret and the position and orientation of the second turret.

1           35.     The vehicle according to claim 34, wherein the display is capable of  
2   displaying graphics, and wherein the feedback information is provided by a rendering  
3   on the display of the position and orientation of the first turret and by a rendering on  
4   the display of the position and orientation of the second turret.

1           36.     The vehicle according to claim 34, wherein the feedback information  
2   pertaining to the position and orientation of the first turret is displayed simultaneously  
3   with the feedback information pertaining to the position and orientation of the second  
4   turret.

1           37.     The vehicle according to claim 34, wherein the feedback information  
2   pertaining to the position and orientation of the first turret and the feedback  
3   information pertaining to the position and orientation of the second turret are  
4   displayed separately on separate display screens of the display.

1           38.     The vehicle according to claim 20, wherein the vehicle further  
2   comprises a power distribution and control system, the power distribution and control  
3   system further including  
4               a power source,  
5               a power transmission link,  
6               a plurality of output devices, the plurality of output devices including a  
7   plurality of actuators capable of adjusting the mount assembly to adjust the position  
8   and orientation of the turret nozzle,  
9               a plurality of input devices, the plurality of input devices including a  
10   plurality of position sensors capable of providing position information pertaining to the  
11   position and orientation of the nozzle, and the plurality of input devices further  
12   including an input device associated with an operator interface,  
13               a communication network,

14                   a plurality of interface modules; the plurality of interface modules  
15 being coupled to the power source by way of the power transmission link, the  
16 plurality of interface modules being interconnected to each other by way of the  
17 communication network, and the plurality of interface modules being coupled to the  
18 plurality of input devices and to the plurality of output devices by way of respective  
19 dedicated communication links, and the plurality of interface modules including one  
20 or more interface modules that are coupled to the plurality of position sensors, the  
21 plurality of actuators, and the input device associated with an operator interface; and  
22                   wherein the turret controller comprises at least one of the plurality of  
23 interface modules.

1           39.     The vehicle according to claim 38, wherein the operator interface  
2 comprises a display capable of displaying graphics, wherein the vehicle further  
3 comprises a video camera mounted to the turret, and wherein the display is  
4 configured to display I/O status information relating to operation of the turret and  
5 obtained from the plurality of interface modules simultaneously with video data from  
6 the video camera.

1           40.     The vehicle according to claim 39, wherein the video data is  
2 communicated by way of the communication network.

1           41.     The vehicle according to claim 38, wherein the plurality of output  
2 devices include an electric motor and wherein the plurality interface modules  
3 comprise an interface module coupled to drive the electric motor.

1           42.     The vehicle according to claim 41, wherein the interface coupled to  
2 drive the electric motor produces a pulse-width modulated output signal.

1           43.     The vehicle according to claim 38,  
2                   wherein each of the plurality of position sensors is configured to  
3 measure movement about a respective axis,  
4                   wherein the plurality of input devices further comprise a plurality of  
5 pairs of limit switches respectively associated with the plurality of position sensors  
6 and configured to ascertain whether the turret as reached a boundary of movement  
7 about the axis measured by the respective position sensor,  
8                   wherein the plurality of input devices including a plurality of position  
9 sensors capable of providing position information pertaining to the position and

10 orientation of the nozzle, and the plurality of input devices further including an input  
11 device associated with an operator interface,

12 wherein the turret controller comprises calibration logic configured to  
13 calibrate a respective one of the plurality of position sensors and the associated pair  
14 of limit switches based on operator of the other of the respective one of the plurality  
15 of position sensors and the associated pair of limit switches.

1 44. The vehicle according to claim 38,  
2 wherein the plurality of interface modules, the plurality of input  
3 devices, and the plurality of output devices are distributed throughout the fire fighting  
4 vehicle; and

5 wherein each respective interface module is locally disposed with  
6 respect to the respective input and output devices to which the respective interface  
7 module is coupled so as to permit distributed data collection from the plurality of input  
8 devices and distributed power distribution to the plurality of output devices.

1 45. The vehicle according to claim 20, wherein the operator interface  
2 includes first, second, and third operator input devices, and wherein the turret  
3 controller is programmed to deploy to the turret to first, second, and third positions  
4 when a corresponding one of the first, second and third operator input devices is  
5 activated by the operator.

1 46. The vehicle according to claim 45, wherein the first, second, and third  
2 positions are respectively low, medium and high attack positions.

1 47. The vehicle according to claim 20, wherein the operator interface  
2 comprises a system on/off input device, and wherein the on/off input device may be  
3 engaged during vehicle travel to permit the turret to be moved as the vehicle  
4 approaches the scene of a fire.

1 48. The vehicle according to claim 20, wherein the adjustable mount  
2 assembly comprises an articulated boom assembly formed of a plurality of articulated  
3 arms, wherein the vehicle further comprises a plurality of position sensors mounted  
4 to measure angles between the plurality of articulated arms, wherein the turret  
5 controller is coupled to maintain the nozzle in a predetermined horizontal orientation.

1 49. The vehicle according to claim 48, wherein at least one of the plurality  
2 of position sensors comprises a potentiometer.



1           50.     The vehicle according to claim 20, wherein the adjustable mount  
2     assembly comprises an articulated boom assembly formed of a plurality of articulated  
3     arms, wherein the vehicle further comprises a plurality of position sensors mounted  
4     to measure angles between the plurality of articulated arms, wherein the turret  
5     controller is coupled to receive inputs from the plurality of position sensors, and  
6     wherein the turret controller is programmed to perform geometric calculations to  
7     ensure that the angles between the plurality of articulated arms sum to a value which  
8     causes the nozzle to maintain a predetermined horizontal orientation.

1           51.     The vehicle according to claim 50, wherein the horizontal orientation is  
2     parallel to the chassis of the vehicle.

1           52.     The vehicle according to claim 50, wherein the horizontal orientation is  
2     parallel to the chassis of the vehicle.

1           53.     The vehicle according to claim 20,  
2                    wherein the turret controller is programmed to acquire operator inputs,  
3     the operator inputs being useable to generate first control signals to control motion of  
4     the turret, the operator inputs directing movement of the turret in such a way that the  
5     turret is susceptible to impacting the fire fighting vehicle; and

6                    wherein the turret controller comprises comprising an envelope control  
7     module programmed to prevent the turret from impacting the fire fighting vehicle,  
8     including

9                    (1)     determine that the turret is susceptible to impacting the  
10     fire fighting vehicle, and in response

11                   (2)     provide the turret with second control signals that are  
12     different than the first control signals, the second control signals directing  
13     movement of the turret in such a way that the turret does not impact the fire  
14     fighting vehicle.

1           54.     The vehicle according to claim 53, wherein the operator interface  
2     comprises an operator override input device, the turret controller being configured to  
3     process an input from the operator override input device to override the envelope  
4     control module to permit the operator to continue to operate the turret outside of a  
5     permissible travel envelope.